Great (Wet) Streets: Merging Street Design and Stormwater Management to Improve Neighborhood Streets

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"The city must be recognized as part of nature and designed accordingly."
(Anne Whiston Spirn *The Granite Garden* 1984, 5)

"Sustainable landscapes need conspicuous expression and visible interpretation, and that is where the creative and artistic skills of the Landscape Architect are most critically needed."
(Robert Thayer, quoted in France 2003, p. 35)

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Urban Development: Streets and Stormwater

As an indicator of urban development patterns, streets have made their marks on landscapes the world over. Streets dominate the urban landscape, covering up to 30% of the surface of the city (Jacobs 1997). Streets are the threads of urban fabric that weave together our homes, work places, civic spaces, commercial centers, and open spaces. Despite the many benefits that streets provide for human populations, from an ecological perspective, the construction of streets has had predominantly negative consequences. City residents face numerous environmental problems including soil degradation and erosion, poor air quality, light pollution, noise pollution, habitat fragmentation, altered hydrologic regimes and poor water quality (Spirn 1984, Adams 1994). Streets, as ubiquitous elements in urban development, are at the root of many of these problems.

In the developed world, streets are generally perceived to function first and foremost as transportation corridors. Yet, streets are also the mechanisms by which water is transported through the urban landscape. Through the underlying infrastructure of catch basins and pipes, streets are intimately linked to urban aquatic systems. Impervious surfaces of street networks are conduits for stormwater, and are thus responsible for altered hydrology and destruction of aquatic ecosystems in urban landscapes.

Revealing Runoff in the Right-of-Way

It is clear that streets significantly shape economic, social, and natural processes in cities. The increasingly common incorporation of stormwater management systems into the streetscape is an opportunity to merge the goals of street design and stormwater management and to rejuvenate the ecological processes, social fabric, and beauty of neighborhoods. In his book *Great Streets* Allan Jacobs lists the following components of the "best" urban streets: accessibility, bringing people together, publicness, livability, safety, comfort, participation, responsibility, and magic (Jacobs 1996). By blending these features with the stormwater management techniques used in addressing compromised urban hydrology, we propose bringing stormwater to the surface to create ecological streetscapes, in other words "great *wet* streets." Beyond street design and stormwater goals, ecological street design--also known as natural drainage design-- has the additional goals of increasing ecological understanding and building community identity through the employment of alternative urban ecological aesthetics.
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WATER IN URBAN DESIGN From an aesthetic perspective, water has been a central element in urban design throughout history. Incorporating stormwater into the streetscape, through beautiful and deliberate design, may be the latest trend in making water features a part of public life. "Water as a structuring element is central to the art of city building. The creative act of developing city form which expresses the needs and aspirations of its citizens is predicated on an appreciation and understanding of the myths we associate with water and of the symbolic meaning we attach to it" (A. Betsky 1995, in Moughtin 2003). Storytelling and imagery related to water invokes associations of cleanliness, rebirth, washing away of sins, bounty and life, fear and dread. It is also a unifying element; as design elements,, water features can be used to draw literal and figurative connections within the landscape.

Allan Jacobs' criteria relate to the social and economic criteria for urban design, but can easily be translated to natural drainage design. The integration of vegetation and waterways into the streetscape is a way to target environmental goals, but it will also enrich the human experience and help to satisfy livability goals. For ecological streets, we would aim to meet the requirements Jacobs lists, while broadening the definition of a great street by adding stormwater management and environmental stewardship to the list. After all, the interplay of stormwater and streetscapes (whether the result is positive or negative) mirrors cultural values about the role of natural processes play in cities.

RETROFITTING PUBLIC SPACES FOR STORMWATER Some may argue that space is a limiting factor when merging street design and stormwater management. Yet, on many residential streets, stormwater can often be easily accommodated within the public right-of-way. And as public rights-of-way typically comprise nearly a third of the area of cities, there is an opportunity to treat storwmater at its source. Re-envisioning established street dimensions through a new set of goals reveals that space allocated to cars may be overly generous; for example, in Seattle residential rights-of-way are typically 60 ft. wide and entirely paved. Beyond automobile transportation, residential street networks of these proportions can easily accommodate other functions. "Public spaces should be shared between uses and users" (Moudon and Untermann 1991). Addressing multiple modes of transportation and providing environmental benefits through implementing stormwater management strategies are a sensible use of public space.

Recent urban design trends have led to increased interest in creating accessible and "walkable" neighborhoods. Accordingly, designers and planners, recognizing that pedestrians bring life to the street, allocate space in the right-of-way for pedestrian amenities. A similar process should be considered to create space for water in the streetscape. In fact, in Seattle, the impetus for natural drainage projects often arises out of the need for new sidewalks where streets are being retrofitted or drainage networks formalized. The act of retrofitting of urban streets has been recognized for its potential to connect green open spaces, develop recreational spaces, and control noise and air pollution (Moudon and Untermann 1991). Through ecological street design, we can also offer the means to manage stormwater both functionally and aesthetically.

Understanding and Connecting with Place through an Ecological Aesthetic

The shift toward ecological street design has implications beyond ecological enhancement. Natural drainage streets have the potential to alter the way in which we relate to the built environment. They provide the opportunity to increase ecological understanding and to highlight local and regional identity. Consideration of cultural relationships to infrastructure design and promotion of ecological understanding can serve to reveal connections between humans and the urban ecosystems they inhabit.

THE URBAN VIEW OF NATURE The current state of the urban environment is one that illustrates and promotes a disconnection between human action and ecological consequences. A closer look at the modern city reveals that nature is largely invisible or at most, confined to small pockets. Connections between city processes and ecological processes are subverted because, Michael Hough suggests, "notions of humanity and nature are understood to be separate issues" (Hough 1995, p. 10). We often define nature as outside the city. Yet, hidden beneath the façade of concrete and metal, ecological processes are hard at work even in the most urban of places. They may look different – water moves in pipes instead of streams, trees are dispersed by humans instead of wind or birds, constructed materials decay in the place of plant and animal debris – but these natural processes are working within the city, just as in the landscape beyond. It is likely that many people give little consideration to the ecological machinery of the city in their daily lives. Most city-dwellers rarely encounter the direct connection between the gutter and the aquatic habitat at the end of the pipe. Meanwhile, the surfaces of the city landscape collect and direct water just as the soil and vegetation in non-urban landscapes do. "We are never outside of nature" yet cognitively we may separate the functions of city and nature (Cronon 2002).

While we promote raising awareness about the ongoing ecological processes within cities, we must also recognize that urban places, perceived to be "natural areas," are often ecologically dysfunctional. The nature we know and celebrate in cities is often only superficial or symbolic. Structurally and functionally, patches of urban nature do not cumulatively comprise complete ecosystems. Although integration of nature is often the theoretical goal of recent development in cities and suburbs, new towns incorporate only the "trappings of nature like trees, gardens, and lakes, but are built with little regard for the processes of nature" (Spirn 1984, p. 1). The misconception that these landscapes are "natural" may be a side effect of a societal lack of ecological understanding. (By contrast, stormwater management in streets contributes valuable ecological functions to the urban environment, regardless of whether these systems are designed to look "natural.")

ECOLOGICAL UNDERSTANDING Ecological understanding is "the expectation and awareness that human actions have consequences and that an intricate web of relationships connects patterns and processes in the physical, biological, and social environments" (Hill et al. 2002, p. 272). A recent movement in landscape architecture, called "eco-revelatory design," promotes the enhancement of ecological understanding through design. "Design has the capacity to make the invisible visible…our task is to comprehend patterns, divine meaning, and communicate understanding" (Helphand and Melnick 1998, p. ix). In fact, design may foster "moments of extreme clarity and insight with the potential to transform our consciousness and guide future action" (Helphand and Melnick 1998, p. ix). This theory suggests that design interventions that enhance ecological understanding may motivate future actions by people who are better informed of the ecological consequences they set in motion.

IDENTIFYING WITH COMMUNITY AND REGION It is common to hear communities express dismay that their towns and cities are taking on the look of "Anywhere, USA" or "Generica." These generic landscapes reflect little variety from place to place, even though the regional ecology and cultural dynamics may vary greatly. Such landscapes are analogous to the typical application of street design in which rigid "one-size-fits-all" standards are applied regardless of local varied and specific goals.

Raising our ecological understanding of places through design of ecological streets, designers can enrich streets to reconnect human communities with their local ecological communities. Such connections serve to foster a unique sense of place and identity based in native species and local ecological patterns. "Places should have a clear perceptual identity: recognizable, memorable, vivid, engaging of attention, differentiated from other locations" (Lynch 1971, p. 225). The public right-of-way, a large part of our outdoor lives, is a sensible place to begin this process of forming and revealing local identity. Incorporating local native species and patterns that reflect ecological processes into urban streetscapes not only adds ecological value, but can provide a unique aesthetic based

in local ecological identity. Joan Hirschman Woodward (1997) suggests that seeing repeated relationships in a particular region allows us to characterize a place. Recognizing patterns in the landscape and assigning meaning to them can provide a basis for sense of place and regional identity in a largely homogenous urban landscape.

Community participation in the design process may also enhance ecological understanding. Designers and residents can mutually educate each other about their locations in the watershed, and illustrate the connections between actions and ecology. Carolyn Merchant describes eco-revelatory design as a "partnership between people and nature" (Merchant 1998, 69). Inviting community members to take an active role in developing this partnership is an opportunity to teach a deeper understanding of ecological issues. Participation can begin to restore understanding by involving residents in the development of the stories of the landscape and creation of metaphors about the processes occurring in the natural world.

TAKING ECOLOGICAL UNDERSTANDING TO THE STREETS Ecological street design goes beyond functionless symbolic imagery of nature. Done well, streets have the potential to reconnect us with local communities and ecosystems. Designers can help to promote ecological understanding by designing landscapes that both preserve and reveal ecological functions. To increase legibility of urban ecological functions, one option is to "expose infrastructure processes commonly hidden" (Brown, et al. 1998, p. xvi). For instance, natural drainage systems convey stormwater on the surface of the landscape where we can see it flow from pavement into a swale. We see that the stormwater runoff is supporting the plants that inhabit the drainage system. We may also observe that the substances we deposit on the surface of our landscape-- like the oil from our cars and eroded soils from our yards-- will be carried via the runoff into natural drainage systems. We may begin to understand the connection between our actions and environmental consequences.

The incorporation of visual clues or symbols of an underlying function is another strategy for enhancing ecological understanding. The designers of Seattle's SEA Street and Broadview Green Grid projects have drawn attention to these streets through creating meandering pavement throughout the right of way, hinting at the flows within the greater watershed. At Seattle's 110th St Cascade, a series of stair-stepped swales, full of native vegetation, detains and treats stormwater as it flows downhill; the project functions as a tributary to an urban creek.

FIG. 1: Broadview Green Grid, Seattle.

FIG. 2: 110th Street Cascade Project, Seattle.

Visual clues and symbols can also include artistic treatment of infrastructural elements like the grates on curbs, sedimentation structures, and French drains. For example, the inlets designed by a local artist that are used within the High Point natural drainage project in Seattle suggest the flow of the creek that lies at the bottom of the development's watershed. More obvious visual elements, such as interpretive signs, directly explain stormwater

functions with words and diagrams. With such strategies, designers can suggest the connections between the road, the roadside swale, and the stream or shoreline that is intrinsically connected to the streetscape. Designs that make "everyday landscapes" ecologically legible contribute to the richness of experiences for community members and urban dwellers.

To connect people with the watersheds in which they live and with the human communities to which they belong, designers can also use regional icons as a source for inspiration. Regional icons can be the motivating factors around which communities rally. For example, in Seattle, the listing of several salmon populations as "threatened" under the Endangered Species Act has both ecological and cultural implications. Salmon are, and have been since Native tribes were the predominant human residents, Seattle's mascot species. Landscape designs that adopt regional icons have the potential to foster cultural identity through shared place-based experiences. Accordingly, the best ecological streets use native plants, well-suited to local microclimates, and implement street designs that draw insight from the local context and preferences of neighbors.

Similarly urban landscapes that evoke resident participation may contribute to community building, and collective interest in the local environment. For example, residents along Seattle's SEA Street natural drainage project participate in the maintenance of plants within the right-of-way. They become environmental stewards while simultaneously taking responsibility for the care of public spaces in their local community.

FIG. 3: Artistic rendering of stormwater infrastructure.

FIG. 4: Neighbors participate in SEA Street gardening, Seattle.

AESTHETICS & STORMWATER STREETS Appropriate and attractive solutions for streetscapes are attainable and should reflect neighborhood preferences and the goals of each project. We must not think of natural drainage streets as having only one possible "look," but stretch our imaginations and plant palettes to explore and apply design options that are well-suited to the sites in which they are installed.

Public acceptance is crucial for ecological street design to gain momentum as a movement. Landscape architects play an important role in this process. "By first being palatable, landscape aesthetics ultimately can go beyond the merely acceptable to evoke intelligent tending of the land so that aesthetic decisions become intrinsically ecological decisions" (Nassauer 1997, 72). Acknowledging that there is potential for ecological street to be expressed in an infinite number of ways, we consider three different types of urban residential design aesthetics that might be used to respond to concerns about the appearance of ecological streets:

The “orderly” street design, inspired by the design for Seattle’s High Point project, is one that might be seen in a typical low- to medium-density urban setting (FIG. 5). Street trees and grass are the predominant vegetation, framing the streetscape and only subtly alluding to the fact that natural drainage strategies are being employed in the right-of-way. This aesthetic uses shallow swales and further takes advantage of space available beneath the ground, relying on subsurface systems for stormwater detention and water quality improvements.

FIG. 5: “Orderly” street design aesthetic.

FIG. 6: “Naturalistic” street design aesthetic.

The “naturalistic” street design was inspired by Seattle’s SEA Street. This “look” is characterized by native vegetation arranged within open bioretention swales. Plants are selected and placed based on their tolerances to water level fluctuation and local seasonal variations in climatic conditions. Depending on the plants selected and the proximity to patches of habitat within watersheds, this aesthetic also has the potential to form important habitat linkages within the street network. Note also that the naturalistic model does not necessarily convey a wild (messy) appearance. Trimmed edges of vegetation clusters are a sign that resident care for the street (FIG. 6).

FIG. 7: “Expressive” street design aesthetic

The “expressive” street design aesthetic, is one in which neighbors must be highly involved in the plant selection process (FIG. 7). In this concept, property lines are visually extended to the pavement edge, such that the right-of-way takes on the appearance of each privately owned parcel adjacent to the street. Much like a public community garden, or p-patch, neighbors are responsible for the care of the right-of-way plants nearest to their properties. In exchange for these maintenance contributions, neighbors have more control over the plant selection in their front yards. The Maplewood Minnesota designs for “rain gardens,” for which neighbors are able to choose from a set of plant palettes to grace their respective portions of the public right-of-way, are sources of inspiration for this aesthetic concept.

"By acknowledging the profound changes in urban streams and by embracing both naturalistic and cultured (designed) landscapes as acceptable models for environmentally responsible design, a new realm of urban stormwater management can be explored that allows a broader range of design expression" (Wenk 1997, p. 437). To fully explore this realm, we advocate for consideration of both conventional street design styles and designs that to vary from aesthetic norms. Straying from convention is an integral part of the practice of design; landscape architects have the potential to innovate new aesthetic conventions that incorporate eco-revelatory design principles. Our hope is that through designing creatively, and strategically taking advantage of opportunities to promote environmental education in the streetscape, this shift in aesthetic paradigms can take place.

Why Ecological Streets?

The juxtaposition of the two terms: 'ecological' and 'streets,' creates a new concept, and inherently elicits compromise. We suggest here that streets are intrinsically "*un*-ecological." If we wanted to be truly 'ecological,' we would eliminate cars, tear up the pavement, and plant food forests, gardens, and native tree species. But streets are also here to stay and, culturally, contribute greatly to urban design. The streetscape is a ubiquitous landscape in every city, and therefore its potential for ecological design should not be overlooked. Within the emerging field of natural drainage systems design, opportunities are abundant. These include designing: to mitigate some of the negative ecological effects of urban development patterns by treating pollution and runoff flow at its source; to reveal and educate the public about urban ecology; and to bring together communities, through the shared experience of regional landscapes. As the backbones of neighborhoods the world over, streets are a place where ecological design must be introduced.

Whether aimed at achieving environmental goals or livability goals, the momentum of community-driven efforts for city improvements cannot be ignored. We are reminded that: "Changes to streets are normal activities. Over and over again, people vote significant sums to make a particular street better, to be a special place" (Jacobs 1997, p. 5). Beyond stormwater treatment, ecological street design can be used to heighten ecological awareness, highlight a neighborhood's identity and foster community participation. There is a growing need to reclaim city streets for a more expansive view of public life (Lyndon 1997). We suggest that *great wet streets* design provides a way to meet that need. On behalf of human and non-human beings, now and in the future, we must nurture the opportunity that exists at this moment in time, to recognize ecology in cities and design accordingly.

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